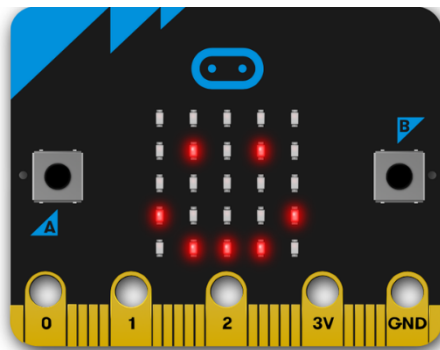


micro:bit fox-hunting

20 avril 2021

Searching for beacons is a technique widely used in science, to find and study the wildlife in their natural environment. It can also be useful for searching for people buried in the snow by an avalanche. Among ham radio operators, it is a radio-finding sport, also called "fox-hunting", that is a race to find all beacons as quickly as possible.

The aim of the game is to find the micro:bit as a radio beacon, hidden in nature using the handheld micro: bit receiver .



With the micro:bit, you do not need permission to use it because of the 2.4 GHz free band, therefore no additional equipment is required.

This file will teach you how to set and program fox-hunting game devices and how to use them playing in the wild.



WHAT IS A MICRO: BIT?

It is a small computer, a microcontroller to be more precise. It has a LED display, two buttons on the front, a connector and several sensors: temperatures, a compass (a magnetometer), vibration/tilt (an accelerometer).

This program uses puzzles that will provide instructions as shown below.

This is done online using the site: <https://makecode.microbit.org/>

Plug the micro:bit on the computer using a USB cable. It behaves then as a USB key, then drag and drop the file program to the USB key.

HOW TO PUT THE PROGRAM IN THE MICRO:BIT?

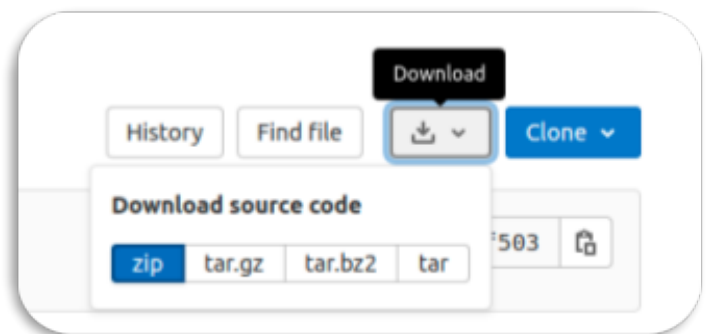
1. Download the file from Scouts et Guides De France GitLab:

https://gitlab.com/sgdf/radioscoutisme/microbit_RS/-/tree/master/baliseTRX

(then click on Download then ZIP)

2. Unzip the file.
3. Connect the micro:bit, it appears as a USB key.
4. Drag and drop the file (.hex) onto the micro: bit.
 - The micro:bit will flash behind the side of the USB socket. Let it do this and wait.
 - The micro:bit will disconnect and reconnect by itself.
5. Once reconnected, eject the micro:bit (same process as an ordinary USB key) and that's it.

Et voila.





To use the micro:bit in the receiver mode, to search for the beacon, you just need to turn it on. It will show RX (RX = radio reception), then a bar graph will show you the signal's strength.

To use the micro:bit like Beacon (the one to search), press without releasing the **B button**, plug the battery to the micro:bit, and release the **B button** when the display says TX (TX = transmit radio). A single led in the center will light up each time the beacon is transmitted.

Hide this beacon well. The higher it is, the farther it will transmit, the more fun it is.

- **Please note that the circuit cannot withstand water** or humidity.

To protect it, a plastic box like a Tupperware, a jar of jam, or a ziplock bag will do the job.

- **Beware of short circuits !**

protect it from direct contact with metal parts or aluminum foil by placing it in an envelope or cloth.

If you hide it in a metal box, or something similar to metal, unfortunately, it will not be detectable. In a ground hole, it will barely reach a meter or two.

It's up to you to try :)

When the game is over, just unplug the batteries.



TO GO FURTHER:

DIY: PROGRAM YOUR OWN FOX-HUNTING

EQUIPMENT YOURSELF Have a look at the website <https://makecode.microbit.org/>

When you open MakeCode you are greeted with two blocks: the On Start block and the forever block. The On Start block is all of your code that will execute at the very beginning of your program and only run once.

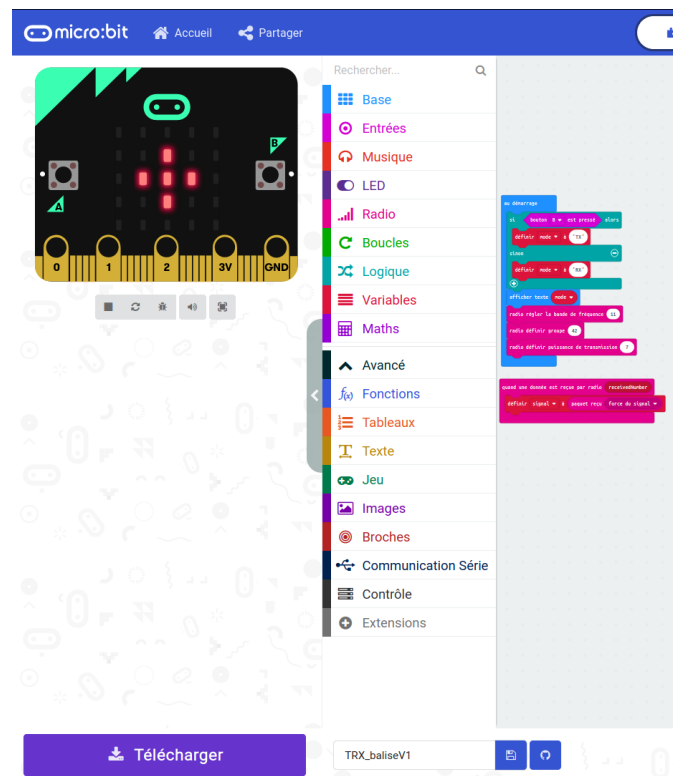
The forever block is code that will loop over and over again...forever.

HOW TO PROGRAM THE MICRO:BIT?

On the left of the window, you see a virtual micro:bit, which allows us to see what is happening on the display in real time after each modification of the puzzle program.

Close to it, there is a list of puzzle instructions that we will choose and drag and drop into the programming area to the right.

It's very easy, don't hesitate to search and follow online video tutorials to understand the first steps.





AT THE BEGINNING

Reading is fairly straightforward. The blue zone “On Start” will do all the instructions, starting at the top, and going down step by step.

Quite similar to the “SCRATCH ” style programming, it is quite intuitive to understand.

Scratch is a manipulable and executable graphical programming language for educational purposes.

When pressing the B button while connecting the battery, the micro:bit starts the beacon mode. It will display TX on its led screen. This is the one micro:bit we will hide.

If you simply plug in the batteries without doing anything else, the micro:bit will display RX and will be in the receiver mode, then display a bar graph reminding you of what you see on phones. The bar graph indicates the strength of the received signal.

The pink areas, starting with “radio”, show us the configuration of the radio part. We define the frequency, the name of the micro: bit group (in digital) playing this game. The choice is at your convenience, the important thing is that this information must be identical to all the micro: bits in this game. The signal strength can be set up to the max, that is, 7.

Seven will allow the beacon to be found at 20 -30m distance.

Set to the minimum, it will only work a few cm.

```
on start
  if button B is pressed then
    set mode to "TX"
  else
    set mode to "RX"
  show string mode
  radio set frequency band 11
  radio set group 42
  radio set transmit power 7
```





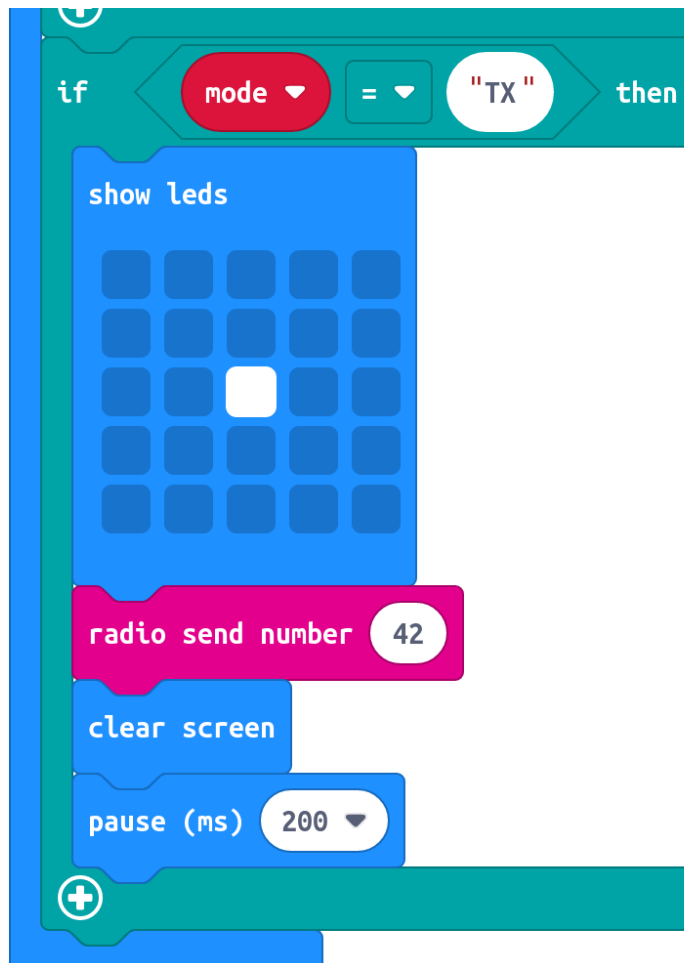
BEACON MODE

If **B** was pressed while powering up, the micro:bit will go into **Beacon mode** until both AAA batteries are exhausted, or the device is turned off.

The central LED on the display flashes each time the micro:bit sends its beacon on the air.

Here we just send the number 42, but any number will work.

Between two transmissions, there is a pause of 200ms.





Receiver MODE

Each time we receive a frame from the beacon, and we are in receiver mode (RX), we can measure the signal strength.

```

on radio received receivedNumber
  set signal to received packet signal strength
  
```

The signal strength will be below -90 when it is very weak and down to -40 when the signal is very strong.

If we get closer to the beacon, the signal strength will increase, so the bar graph will get bigger and bigger. When you are right on the tag, the symbol changes to a kind of circle.

```

if node = "RX" then
  if signal < -90 then
    show leds [1x1]
  else if signal < -80 then
    show leds [2x2]
  else if signal < -70 then
    show leds [3x3]
  else if signal < -60 then
    show leds [4x4]
  else if signal < -50 then
    show leds [5x5]
  else if signal < -40 then
    show leds [6x6]
  else
    show leds [6x6]
  
```

NOTES:

There is a "bug":

If we no longer receive the signal from the beacon abruptly, for example if someone had turned off the beacon, the receiving micro:bit will no longer update its bar graph. It can be full all the time.

